THE EVALUATION OF

Results Obtained on Available Types of Fiber Strength Testers Using Various Gauge Spacings

AND THEIR RELATION TO YARN STRENGTH

By
Samuel T. Burley, Jr.
and Frances Carpenter,
Cotton Technologists

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service

September 1955 AMS-71 Washington, D. C.

CONTENTS

ooOoo

This study was planned and conducted under the administrative direction of John W. Wright, Chief, Standards and Testing Branch, Cotton Division. Appreciation is expressed to Joseph T. Rouse, George E. Gaus and Wallace L. Ashby for technical and statistical assistance; and to members of the Washington and field fiber laboratories for assistance in performing the tests.

SUMMARY AND CONCLUSIONS

The purpose of this study is to evaluate available types of cotton fiber strength testers and to ascertain the comparative significance of test results obtained by means of these instruments from the standpoint of relation to yarn strength.

A comparative evaluation of the Pressley, Clemson, and Stelometer cotton fiber strength testing machines shows that the three machines are measuring essentially the same fiber property. The results of tests made on each of the three machines using 3 mm. gauge spacings were comparable, that is, one machine was not proven to be superior to another in explaining variation in, or predicting yarn strength. The results obtained on the three machines, however, are on different levels of strength values.

It was found that strength test results of maximum significance could be obtained at slightly more than 3 mm., hence 1/8" (3.2 mm.) gauge spacing was adopted as standard by the Standards and Testing Branch of the Cotton Division, U. S. Department of Agriculture.

Test results obtained from the Pressley and Stelometer testers are slightly more precise than those obtained from the Clemson tester. This is attributed to the fact that more exact readings may be made from the direct reading scale of the Pressley and Stelometer testers than from the chart used with the Clemson tester. The Clemson tester is slightly faster to operate than either the Pressley or the Stelometer. The Stelometer clamp loading technique requires slightly more time than the Pressley clamp loading technique.

In the preliminary work it was found that bundle widths from 1/8" to 1/4" gave essentially the same results when the 3 mm. gauge spacing was used. Continued use of the narrow bundle widths, however, was found to damage the leathers of the clamps, hence the 1/4" bundle width has been adopted as standard procedure for testing by laboratories of the Cotton Division of the Agricultural Marketing Service.

A torque within the range of 10 to 18 inch-pounds when the 3 mm. gauge spacer was used, gave comparable results.

Fiber length seems to have little, if any, effect on optimum gauge spacing within the range of 0 to 4 mm.

The results obtained from the Stelometer tester by either the Pressley or Stelometer clamp loading technique give essentially the same coefficient of correlation when such results are used in multiple correlation analyses with the dependent variable being the strength of 22s carded yarn and the independent variables being upper half mean length, fiber tensile strength, fineness and maturity by the Causticaire method. When the results obtained by these two clamp loading techniques are used in simple correlation analyses with 22s carded yarn strength,

the coefficient of correlation for the Stelometer technique is slightly higher than that for the Pressley technique, although the difference is statistically insignificant.

Results of tests made on 323 commercial cotton samples using the 1/8" gauge spacing explain much more of the variation in strength of 22s yarn than the results for the same samples using the "0" gauge spacing.

THE EVALUATION OF RESULTS OBTAINED ON AVAILABLE TYPES OF FIBER STRENGTH TESTERS USING VARIOUS GAUGE SPACINGS AND THEIR RELATION TO YARN STRENGTH

By

Samuel T. Burley, Jr. and Frances Carpenter
Cotton Technologists

Cotton fiber strength has recently become recognized as an important factor of quality in the marketing and processing of cotton. An increasingly larger proportion of the crop is being marketed on the basis of specifications for fiber strength. In view of this trend, cotton breeders are giving special attention to fiber strength in their breeding programs which are designed to develop strains and varieties of cotton of improved spinning performance. This widespread interest in cotton fiber strength has caused attention to be focused on the development of more reliable and expeditious methods and equipment for measuring fiber strength. The study upon which this report is based was designed to provide an objective evaluation of equipment now available for this purpose, and of gauge spacings, space settings and related techniques to be used.

Fiber tensile strength is positively related to yarn strength as has been shown by every type of machine used for testing fiber tensile strength. In recent years much work has been done to improve the methods for measuring strength of fiber and related properties, such as elongation and stress-strain measurements. The use of various gauge lengths in fiber strength testing to secure a higher correlation with yarn strengths has been studied for several types of testing equipment and the results to date have been somewhat controversial.

Mr. J. K. Phillips of the Goodyear Research Laboratories reported on a study in this field at the Cotton Research Clinic, February, 8, 1951, in which he used the Scott IP-4 machine with the standard Pressley clamps. He reported finding that a gauge length of 5 mm. gave a higher correlation with tire cord strength than the "0", 2.5, and 7.5 mm. gauge lengths. Mr. George Pfeiffenberger, formerly of Chicopee Corporation, reported at the Cotton Research Clinic, February 18, 1953, that the "0" gauge gave the highest correlation with yarn strength when the Pressley instrument was used for a series of cottons where grade, color, staple length, and fiber fineness were held constant and fiber strength was the only variable. Gauge lengths of "0", 2.5, 5, and 7.5 mm. were used. Dr. Hugh Brown, Dean of the Clemson Textile School, at the same meeting, reported on the use of "0", 2, 4, 6, and 8 mm. gauge lengths with Pressley clamps on the Clemson Flat Bundle Strength Tester. Dr. Brown found higher correlation with yarn strength at 2 and 4 mm. gauge lengths than at any others used.

Since the Pressley and the Clemson Flat Bundle Strength testers were available, a study was made to determine the comparative significance of results obtained by the use of various gauge spacings on these

two machines and the relationship of such results to the strength of 22s carded yarns. A Stelometer was later obtained for use in connection with other phases of the evaluation.

CHARACTERISTICS OF TESTING INSTRUMENTS USED

Pressley Strength Tester:

The Pressley tester is an inclined plane type of machine which has an increased rate of loading according to the position of the weight along the beam (fig. 1). This equipment was not originally designed for testing with various gauge lengths, but a machine was adapted for use in such tests to take spacers of "0", 2, 3, and 4 mm. In the use of the standard Pressley test at "0" gauge length, it is standard procedure in the laboratories of the Cotton Division of AMS to use a beam incline of 1-1/2° when loaded clamps are in place and the weight is at zero, and an incline of 3° when the weight is at 15 pounds resting on the brake bar with the clamps removed. Because of the effect of elongation of fibers when other than "0" spacing was used, it was necessary to increase the 3° to approximately 4° in order to get a good break.

Clemson Flat Bundle Tester:

The Clemson Flat Bundle Tester has a constant rate of loading of 1,000 grams per second (fig. 2). It is designed to test samples of any gauge length from "0" to 10 mm. Standard Pressley technique and accessory equipment were used with this machine.

Stelometer:

The Stelometer is a direct reading pendulum type fiber breaker which provides uniform inertia free loading (fig. 3). Standard Pressley jaws are used to clamp the fibers. Samples are prepared as for a Fibrograph test. Specimen were taken from this combing and were prepared and clamped in an especially designed vise which provides means of prestressing the sample to 100 grams. A torsion spring on the vise also provides a means of accurately controlling the tension on the fiber jaws.

PRELIMINARY STUDIES

Before setting up a procedure for testing cotton fiber strength at various gauge length spacings, it was necessary to make several preliminary studies using the two testers available at the time.

A series of tests was made on the Clemson tester using the same procedure as generally used for the Pressley instrument at the so-called "0" gauge spacing. It was found that the results from the Clemson tester were on a lower level of strength values than those obtained on the Pressley tester, probably due to the difference in rate of loading.

Figure 1.--Pressley tensile strength tester and accessories

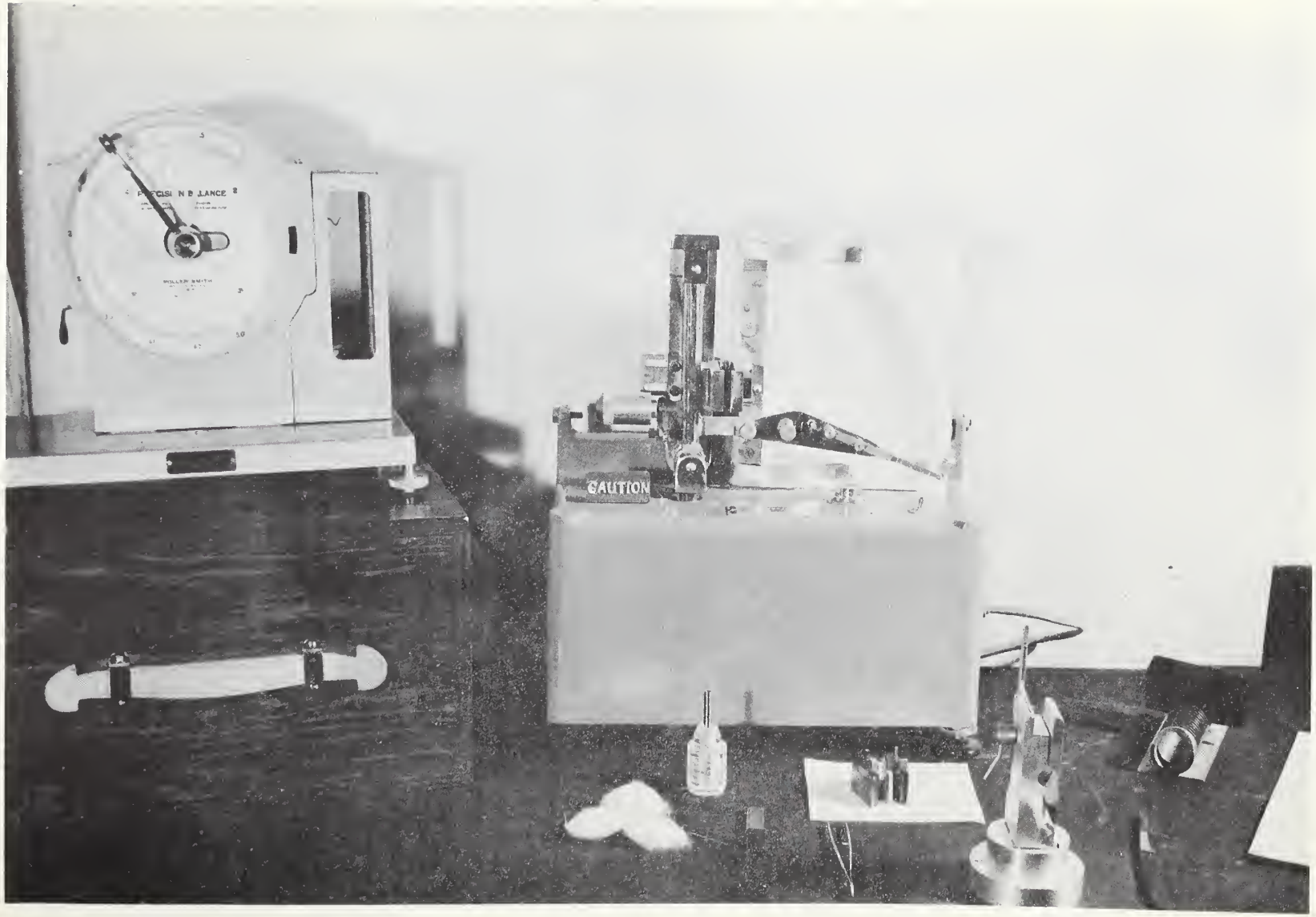

Figure 2.--Clemson flat bundle tester and accessories

Figure 3.--Stelometer tensile strength tester and accessories

A second series of tests was made on seven check test cottons by two technicians making six breaks each on each sample using gauge lengths of "0", 2, 4, 6, and 8 mm. In an attempt to eliminate variations resulting from bundle width and clamps, it was decided to use one set of clamps and a uniform bundle width for all testing. Since the results from this series of tests indicated that the 6 and 8 mm. gauge lengths were less accurate than those for the other gauge lengths, especially for the short cottons, it was decided that further studies involving the two machines, Clemson and Pressley testers, would be limited to a maximum gauge spacing of 4 mm.

A third series of tests was made to determine the effect of torque (inch-pounds) on the breaking strength of cotton fibers for both 1/8" and 3/16" bundle widths. A torque wrench, with graduations in inch-pounds torque was used for tightening the clamps. The amount of torque applied to the clamps varied from 6 to 24 inch-pounds in intervals of 2 inch-pounds. The results indicated that any torque between 10 and 18 inch-pounds would not affect the results appreciably. A wrench of 14 inch-pounds torque was selected and used on all further tests.

A fourth series of tests was made to determine the effect of bundle width on the level of fiber tensile strength when using bundle widths of 1/8", 3/16" and 1/4" on both the Clemson and Pressley testers at a 3 mm. gauge spacing. Tests were made of four cottons on each macine for two consecutive days. The results are shown in table 1. These results indicate that the two testers are on different levels of strength values, but bundle width does not make a significant difference when testing with a 3 mm. gauge spacing.

SPECIAL STUDY OF SELECTED COTTONS

Seventy-five cotton samples were selected to include a wide range of fiber and spinning properties (classers' length, 7/8" to 1-3/16" - standard Pressley strength, 62,000 to 109,000 pounds per square inch - 22s carded yarn strength, 86.9 to 160.2 pounds). Careful selection was made so that various yarn strengths would be included for each staple length. Six tufts were prepared for each sample for each of two machines. The Clemson tester was operated according to the instructions for the use of the machine. The same clamps, wrench, and the 1/8" bundle width were used throughout this test. The grams required for each break were read to the nearest 50, and then were converted to pounds so that the index could be calculated. Gauge lengths of "0", 2, 3, and 4 mm. were used.

The Pressley machine was set up as described in the preliminary procedure, that is, with a beam incline of 1-1/2° when loaded clamps were in place and the weight at zero. When the "0" gauge length was used, a 3° incline with the weight at 15 pounds resting on the brake bar and with clamps removed was followed. For the other gauge lengths, 2, 3, and 4 mm., the 3° incline was increased to 4° in order to get a good "break". The

Table 1.--Comparison of corrected strength-weight ratios 1/ for 3 mm. gauge length on check cottons for Clemson and Pressley Strength Testers

Tester and Sample	Bundle width 1/8"			Bundle width 3/16"			Bundle width 1/4"		
	Test 1	Test 2	Average	Test 1	Test 2	Average	Test 1	Test 2	Average
Clemson:									
A	3.54	3.46	3.50	3.56	3.51	3.54	3.61	3.44	3.52
B	3.65	3.61	3.63	3.69	3.57	3.63	3.64	3.45	3.54
C	3.77	3.67	3.72	3.75	3.77	3.76	3.57	3.61	3.59
D	4.31	4.41	4.36	4.36	4.34	4.35	4.24	4.11	4.18
Average			3.80			3.82			3.71
Pressley:									
A	4.06	3.90	3.98	4.01	4.01	4.01	3.99	3.99	3.99
B	4.04	3.99	4.02	4.08	4.08	4.08	4.11	4.15	4.13
C	4.06	4.06	4.06	4.33	4.25	4.29	4.15	4.31	4.23
D	4.94	5.02	4.98	5.03	4.90	4.96	4.93	5.07	5.00
Average			4.26			4.34			4.34

1/ Breaking strength in pounds divided by specimen weight in mg.

same clamps and a wrench set for 1¼ inch-pounds were used and the bundle width of 1/8" was selected in order to keep the specimen preparation as nearly the same as that for the Clemson tester as could be done.

The strength-weight ratio was obtained for each break and the average strength-weight ratio per sample was calculated. The average ratio was corrected for length for each of the gauge lengths to an equivalent of "0" gauge length.

The Stelometer was adjusted and calibrated as suggested in the procedure for the operation of the machine except that a 3 mm. spacer instead of a 1/8" spacer was used so that a comparison could be made with the results obtained on the Clemson and Pressley testers for the same 75 selected cotton samples previously tested. The suggested procedure for clamp loading using a Fibrograph combing was used for one series of tests on the Stelometer using six breaks per test. Strength readings were made to the nearest .01 kg. The strength-weight ratio was calculated as follows:

$$\text{Stelometer strength-weight ratio} = \frac{\text{beam reading in kg.}}{\text{wt. of bundle in mg.}}$$

This ratio was converted to gr/gx by multiplying the ratio by 1.5 which is the length of the sample in mm.

The standard Pressley clamp loading technique was used for a second series of tests for the same 75 cotton samples on the Stelometer. The ratio and gr/gx were calculated in the same way as above and the 3 mm. spacer was used.

ANALYSES OF STRENGTH RESULTS FOR SELECTED COTTON SAMPLES

Simple correlation analyses were made of the results obtained on each machine for each series of tests using the strength-weight ratios as independent variables with strength of 22s carded yarn as the dependent variable. The correlation coefficients obtained from these analyses are shown in table 2. The $\bar{r}$ values for the various gauge spacings for the Clemson and Pressley testers with yarn strength are shown graphically in figure 4. Standard errors are shown in figure 5. Since the 3 mm. gauge spacer was the only one used with the Stelometer the results for that instrument are not included in figures 4 and 5.

It will be noted that the highest $\bar{r}$ value obtained is for the 3 mm. gauge spacing for the Stelometer using the Stelometer clamp loading technique. The second highest $\bar{r}$ value obtained is for the 3 mm. spacing on the Pressley machine. The third highest $\bar{r}$ value is for the 3 mm. spacing on the Stelometer using Pressley clamp loading technique. The fourth highest $\bar{r}$ value is for the 3 mm. gauge spacing for the Clemson tester. The differences between these four values do not show one to be statistically more significant than another.

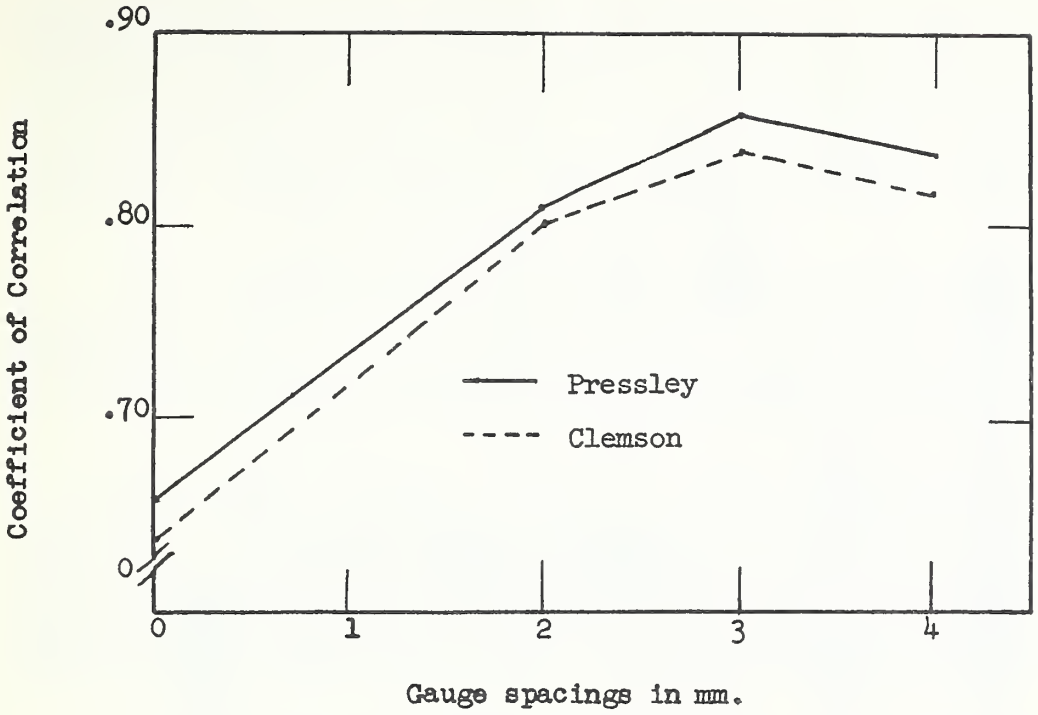

Fig. 4 - Coefficient of correlation between 22's yarn strength and fiber tensile strength at various gauge spacings for Pressley and Clemson tester.

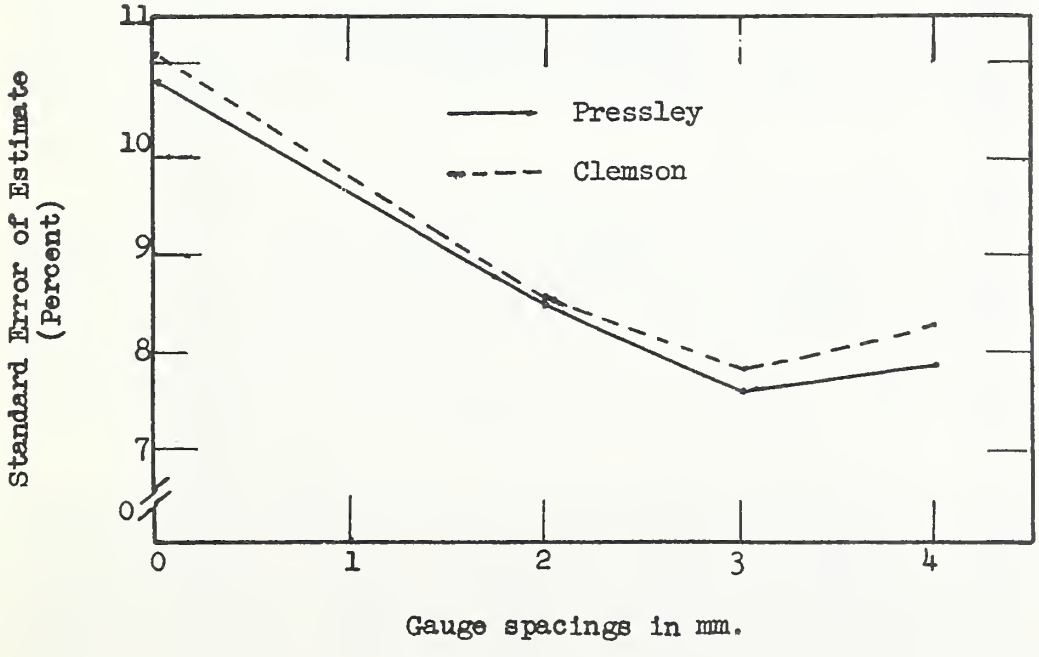

Fig. 5 - Standard error of estimate between 22's yarn strength and fiber tensile strength at various gauge spacings for Pressley and Clemson testers.

Table 2.--Correlation coefficients between 22s yarn strength and fiber strength-weight ratios for three tensile strength testers, using various gauge lengths

Machine or Tester	Gauge Length	Correlation values		
		$\bar{r}$	$\bar{r}^2$	$\bar{S}$
				Percent
Clemson	"0"	0.636 ± .069	0.405	± 11.14
	2 mm.	.804 ± .041	.646	± 8.59
	3 mm.	.841 ± .032	.708	± 7.81
	4 mm.	.819 ± .038	.671	± 8.29
Pressley	"0"	.660 ± .066	.436	± 10.84
	2 mm.	.808 ± .040	.652	± 8.51
	3 mm.	.859 ± .031	.720	± 7.64
	4 mm.	.838 ± .035	.702	± 7.89
Stelometer 1/	3 mm.	.883 ± .026	.779	± 6.79
2/	3 mm.	.851 ± .032	.725	± 7.58

1/ Stelometer machine and Stelometer clamp loading technique.
2/ Stelometer machine and Pressley clamp loading technique.

The $\bar{r}$ values are higher for the Pressley machine than for the Clemson machine for each of the four gauge spacings. Part of the difference in $\bar{r}$ values for these two machines may be attributable to the fact that the Pressley beam readings are more accurately read than are the charts for the Clemson tester. The Pressley beam has graduations of .1 pound and was read to .1 pound, whereas, the Clemson charts are graduated in 200 grams and were interpolated to the nearest 50 grams (.11 pound).

The $\bar{r}$ values for the 3 mm. gauge spacing were consistently higher than for any other gauge spacing. A curve fitted to the correlation coefficients for the various gauge spacings for the Pressley and Clemson testers indicates that a maximum relationship would be found just beyond the 3 mm. gauge spacing or, approximately at 1/8" (3.2 mm) gauge spacing.

A series of multiple correlation analyses were made, using as independent variables the results obtained on the Pressley and Clemson testers for "0" and 3 mm. gauge lengths and the results from each of the two loading techniques at 3 mm. gauge spacings on the Stelometer, together with upper half mean length, fiber fineness (Causticaire) and fiber maturity (Causticaire), with strength of 22s yarn as the dependent variable. The results from these analyses are shown in table 3.

The fiber strength tests using the 3 mm. gauge length gave a much higher correlation coefficient than "0" gauge in every case. The Pressley and Stelometer testers gave somewhat higher $\bar{r}$ values than the Clemson, but the differences were statistically insignificant. The standard errors for the Pressley and Stelometer are approximately equal and are somewhat lower than for the Clemson. The two techniques used for loading the clamps for the Stelometer seemed to have the same effect on results and one can be used as advantageously as the other for strength testing. These results also indicate that the Pressley and Stelometer testers give fiber strength results of equal significance statistically for the multiple correlation analyses.

In order to obtain the effect of fiber length on gauge length testing, this group of 75 cotton samples was divided into two groups for further analysis. One group included 38 cotton samples with Fibrograph upper half mean length of 1.06 inches and shorter; the other group included 37 cotton samples with Fibrograph upper half mean length of 1.07 inches and longer. Simple correlation analyses were made for each group at "0", 2 mm., 3 mm., and 4 mm gauge spacings. The correlation analyses showed that the 3 mm. gauge spacing gave the highest value for each group.

The Clemson machine was found to be slightly faster to operate than the Pressley. This probably is attributable to the fact that the clamps can be removed from the Clemson tester as soon as the break occurs while for the Pressley a beam reading has to be taken and recorded each time before the clamps are removed. Beam readings for the six breaks on the Clemson tester were made immediately after the sixth break had been completed. The Stelometer is slightly slower to operate than the Pressley

Table 3.--Results of multiple correlation analyses of yarn strength as dependent variable and fiber strength, upper half mean length, fineness, and maturity as the independent variables

Fiber Strength Tester	$\bar{r}$	$\bar{r}^2$	$\bar{S}$
			Percent
Pressley:			
"0" gauge	0.848 ± .033	0.719	± 7.66
3 mm. gauge	.925 ± .017	.855	± 5.49
Clemson:			
"0" gauge	.828 ± .037	.685	± 8.10
3 mm. gauge	.901 ± .022	.811	± 6.27
Stelometer:			
3 mm. gauge 1/	.926 ± .017	.858	± 5.45
3 mm. gauge 2/	.924 ± .017	.853	± 5.53

1/ Stelometer using Stelometer clamp loading technique.
2/ Stelometer using standard Pressley clamp loading technique.

or Clemson testers. There is no appreciable difference in time required for testing by the various gauge lengths other than that necessary to change the tester and vise when going from one gauge length to another.

Simple correlation analyses were made of the results obtained on the Pressley tester for each gauge spacing with the results obtained on the Clemson tester for the same gauge spacing. Similar correlations were made of the Stelometer with both the Pressley and Clemson testers using the 3 mm. gauge. The results from these analyses are tabulated in table 4.

From these analyses it would appear that the machines are measuring essentially the same property of cotton fibers and the relationship with 3 mm. spacings seems to be most significant. A comparison can be made of the accuracy of the test results at various gauge lengths, using a measure of error derived from the above correlation analyses between the Clemson and Pressley machines. The standard error of estimates of the average will include, therefore, both within sample variation and differences in the level of testing as shown below:

Parameter	Gauge length			
	0	2 mm	3 mm	4 mm
Within sample variance	0.045	0.020	0.014	0.014
Total variance	.64	.27	.24	.20
Ratio of within to total	.070	.074	.058	.070

The sensitivity of test results at the various gauge lengths can be judged by the ratio of the within sample variance to the total variance. This proportion is a minimum at the 3 mm. gauge length as shown in the preceding tabulation. According to the results of this study, four specimens tested at the 3 mm. gauge length on either the Pressley or Clemson machines will give an average value as accurate as that given by six tests from the Pressley tester at the "0" length.

SPECIAL STUDY ON COMMERCIAL COTTONS

Pressley tests at "0" gauge and at 1/8" gauge lengths were made on 323 cotton samples selected as representive of the commercial crop of the United States in 1954. The cottons tested varied in length from 13/16" to 1-1/4" and all were American upland cottons. The procedure used for "0" gauge testing on the 323 cotton samples was that used as standard procedure in the laboratories of the Cotton Division, AMS and quite generally used by others.

Table 4.--Relationship of fiber strength test results obtained by means of different testers at various gauge lengths

Tester	Gauge Length	$\bar{r}$	$\bar{S}$
			Percent
Pressley with Clemson	"0"	0.921 ± .018	± 4.10
	2 mm.	.915 ± .019	± 4.32
	3 mm.	.941 ± .013	± 3.78
	4 mm.	.921 ± .018	± 4.20
Pressley with Stelometer	3 mm.	.930 ± .016	± 4.08
Clemson with Stelometer	3 mm.	.943 ± .013	± 4.00

The procedure for the 1/8" gauge testing was the same as for "0" gauge except:

1. A 1/8" gauge spacer was used with the clamps.

2. A bundle width of approximately 3/16" was used. (It was found that the use of the 1/8" bundle over a period of time made grooves in the leathers of the clamps and, therefore, was not practical for routine testing.)

3. A 5 milligram capacity balance was used for weighing specimens.

4. Instead of using a check test to determine the bundle width to be used as for standard "0" gauge testing, check test levels were established and results were adjusted to these levels to maintain a constant level of testing from day to day.

In order to establish standard check test averages to be used in maintaining a constant level of testing, sixteen technicians at the five laboratories of the Cotton Division made Pressley tests on five check cottons using the 1/8" gauge spacer and a bundle width of approximately 3/16". Six breaks were made on each sample by each technician on three consecutive days. Calculations were made as follows:

$$\text{Pressley strength-weight ratio} = \frac{\text{beam reading in pounds}}{\text{specimen wt. in mg.}}$$

The Pressley strength-weight ratio for each break and the average per test were calculated and reported to 2 decimal places.

Each morning and each afternoon a check test (six breaks per technician) was made on a check cotton similar to the cotton to be tested. The average ratio per technician was used in obtaining the correction factor to be used in adjusting test results by that technician until time for another check test to be made.

The results for tests made at "0" gauge and expressed in 1,000 p.s.i. and the results from tests made at 1/8" gauge and expressed as strength index will be found in the appendix (table 5-appendix).

ANALYSES OF TEST RESULTS ON COMMERCIAL COTTONS

Simple correlation analyses were made of the results of fiber strength as obtained for both the "0" and 1/8" gauge spacings with strength of 22s carded yarn. The results are shown in the following tabulation:

Gauge length	$\bar{r}$	$\bar{r}^2$	$\bar{S}$ Percent
"0"	.229 ± .053	.052	± 9.99
1/8"	.805 ± .020	.648	± 6.10

It is evident from these results that Pressley fiber strength tests for samples tested at "0" gauge are not nearly so valuable for predicting or explaining 22s carded yarn skein strength as were test results from the same samples using the 1/8" gauge spacing. Tests at "0" gauge gave a coefficient of correlation of .229 and explain 5.2% of the variation in yarn strength while tests with the 1/8" gauge spacing gave a coefficient of correlation of .805 and explain 64.8% of the variation in 22s carded yarn skein strength for this group of samples.

APPENDIX
(Basic Data)

Table 5.--Pressley strength results at both "0" and 1/8-inch gauge spacings for 323 cotton samples of the 1954 commercial crop - USA

Sample Number	Early Season		Mid-Season		Late Season	
	"0" gauge	1/8" gauge	"0" gauge	1/8" gauge	"0" gauge	1/8" gauge
	1,000 p.s.i.	Index	1,000 p.s.i.	Index	1,000 p.s.i.	Index
1	82	91	38	85	83	87
2	72	86	74	83	74	87
3	-	-	-	-	70	85
4	68	91	66	82	69	92
5	93	102	90	92	88	97
6	96	86	92	95	86	90
7	88	93	90	98	86	90
8	89	96	87	85	84	90
9	87	108	84	103	87	104
10	90	120	86	113	85	110
11	85	105	81	103	81	101
12	94	116	92	115	90	119
13	83	113	80	107	79	105
14	90	107	84	106	81	102
15	83	108	82	107	82	105
16	87	106	85	100	82	111
17	82	104	83	105	84	98
18	79	101	79	105	83	107
19	82	108	86	103	82	114
20	90	109	87	115	87	101
21	94	95	97	97	95	92
22	86	101	87	106	82	98
23	84	104	82	108	78	96
24	82	103	80	103	80	95
25	85	107	83	104	76	101
26	86	95	89	91	84	89
27	84	104	87	100	84	94
28	84	98	81	99	77	96
29	82	103	82	96	80	97
30	82	102	83	103	84	95
31	86	105	88	110	87	95
32	89	115	89	101	82	98
33	85	102	84	106	84	101
34	81	102	85	99	84	94
35	80	106	81	101	80	102

Continued on page 18

Table 5.--Pressley strength results at both "0" and 1/8-inch gauge spacings for 323 cotton samples of the 1954 commercial crop - USA (Continued)

Sample Number	Early Season		Mid-Season		Late Season	
	"0" gauge	1/8" gauge	"0" gauge	1/8" gauge	"0" gauge	1/8" gauge
	1,000 p.s.i.	Index	1,000 p.s.i.	Index	1,000 p.s.i.	Index
36	84	105	85	103	85	101
37	89	103	84	109	89	102
38	82	105	84	98	83	96
39	83	107	83	97	87	103
40	85	102	82	101	84	95
41	82	99	84	101	79	96
42	89	103	83	97	78	90
43	82	100	81	90	82	92
44	79	98	76	100	78	94
45	82	100	79	95	78	92
46	81	100	75	95	77	96
47	80	92	83	99	80	95
48	90	99	86	93	81	91
49	89	107	88	103	84	97
50	86	108	85	103	84	97
51	90	104	85	96	86	99
52	83	102	80	103	86	101
53	89	109	86	102	85	97
54	86	98	86	90	84	91
55	85	102	86	110	84	97
56	90	102	83	92	87	93
57	87	105	89	97	87	102
58	83	102	79	97	79	93
59	87	106	78	101	83	104
60	85	104	82	100	82	100
61	92	107	85	99	85	90
62	84	106	85	101	82	94
63	82	106	83	105	82	97
64	89	104	-	-	80	90
65	89	103	83	101	87	97
66	88	103	86	104	87	95
67	88	108	87	100	88	92
68	87	103	83	103	85	97
69	86	103	86	95	82	91
70	83	108	80	100	81	91
71	85	101	83	92	80	88
72	88	101	85	98	84	95
73	83	103	87	102	82	94
74	84	97	84	94	85	90
75	79	99	80	97	79	95

Continued on page 19

Table 5.--Pressley strength results at both "0" and 1/8-inch gauge spacings for 323 cotton samples of the 1954 commercial crop - USA (Continued)

Sample Number	Early Season		Mid-Season		Late Season	
	"0" gauge	1/8" gauge	"0" gauge	1/8" gauge	"0" gauge	1/8" gauge
	1,000 p.s.i.	Index	1,000 p.s.i.	Index	1,000 p.s.i.	Index
76	81	97	78	95	75	97
77	74	102	74	101	78	100
78	88	109	82	103	78	108
79	90	108	86	103	86	97
80	83	103	80	95	81	97
81	84	101	84	98	87	98
82	80	89	78	91	79	88
83	87	95	86	91	85	92
84	83	98	83	88	82	98
85	86	101	82	91	84	94
86	85	95	90	86	84	98
87	85	99	80	94	82	98
88	86	97	80	87	86	97
89	72	86	72	83	74	89
90	87	98	84	92	80	96
91	71	89	75	93	73	92
92	86	100	86	90	80	86
93	92	108	82	103	84	95
94	76	92	80	93	78	87
95	90	94	90	90	86	90
96	86	103	81	95	84	92
97	88	109	87	107	-	-
98	91	109	86	111	89	114
99	93	116	88	114	91	112
100	80	110	79	113	83	101
101	87	110	82	113	-	-
102	85	116	84	118	-	-
103	79	107	82	108	-	-
104	88	116	85	116	-	-
105	86	113	83	115	91	116
106	84	112	83	112	85	108
107	83	105	77	102	80	108
108	90	104	-	-	-	-
109	85	107	90	102	87	104
110	89	103	88	107	81	101
111	89	110	79	111	88	117

☆ U. S. GOVERNMENT PRINTING OFFICE : 1955 o— 359284